WHAT IS CLAIMED IS:

1. A method of canceling communication system noise interference, the method comprising the steps of:

a) receiving T blocks of data, $\mathbf{Y}(:, t)$, $t = 1, \ldots, T$, comprising T blocks of data, $\mathbf{X}(:,t)$, $t = 1, \ldots, T$, transmitted over predetermined subchannels;

b) determining a set of subchannels, $\mathbf{k}(n)$, for the multichannel frequency domain equalizer (FEQ) for subchannel n;

c) generating multichannel FEQ coefficients, $\mathbf{g}(n)$, for the n^{th} subchannel used to transmit the data; and

d) performing multichannel (FEQ) for subchannel n using the generated multichannel FEQ coefficients.

2. The method of canceling communication system noise interference according to claim 1 wherein steps b-d are repeated for each subchannel n used to transmit the T blocks of data.

3. The method of canceling communication system noise interference according to claim 1 wherein the step of determining a set of subchannels, $\mathbf{k}(n)$, for a subchannel n used to transmit the T blocks of data includes selecting subchannel n.

4. The method of canceling communication system noise interference according to claim 3 wherein the step of determining a set of subchannels, $\mathbf{k}(n)$, for a subchannel n used to transmit the T blocks of data further includes selecting neighboring subchannels to subchannel n.

5. The method of canceling communication system noise interference according to claim 3 wherein the step of determining a set of subchannels, $\mathbf{k}(n)$, for a subchannel n used to transmit the T blocks of data further includes selecting subchannels where radio frequency interference is located.

6. The method of canceling communication system noise interference according to claim 3 wherein the step of determining a set of subchannels, $\mathbf{k}(n)$, for a subchannel n used to transmit the T blocks of data further includes selecting subchannels having predetermined noise characteristics.

7. The method of canceling communication system noise interference according to claim 1 wherein the step of generating multichannel FEQ coefficients, $\mathbf{g}(n)$, for subchannel n, comprises solving the equation $\mathbf{g}(n) = \mathbf{Y}(n)^{-1}\mathbf{x}(n)$, where $\mathbf{Y}(n)^{-1}$ is the pseudoinverse of a matrix of received data for subchannels $\mathbf{k}(n)$, and $\mathbf{x}(n)$ is a vector of transmitted data for subchannel n.

8. The method of canceling communication system noise interference according to claim 7 wherein $\mathbf{g}(n)$ is determined adaptively using a block of received data at a time according to an equation defined by: $\mathbf{g}(n) = \mathbf{g}(n) + \mu(t)e(t)\mathbf{Y}(\mathbf{k}(n),t)^{*}$, where $\mathbf{g}(n)$ is the vector of multichannel FEQ coefficients for subchannel n and $\mathbf{Y}(\mathbf{k}(n), t)^{*}$ is the conjugate of a matrix of received data for subchannels $\mathbf{k}(n)$.

9. The method of canceling communication system noise interference according to claim 8 wherein values of $e(t)$ are determined according to an equation defined by: $e(t) = X(n,t) - \mathbf{Y}(\mathbf{k}(n),t)^{T}\mathbf{g}(n)$, where $X(n, t)$ is the transmitted data for subchannel n at time t, and $\mathbf{Y}(\mathbf{k}(n),t)^{T}$ is the transpose of a matrix of received data for subchannels $\mathbf{k}(n)$.

10. The method of canceling communication system noise interference according to claim 8 wherein $\mu(t)$ controls the adaptation according to least mean squares and has a value determined according to an equation defined by: $\mathbf{R} = E\left[\mathbf{Y}(\mathbf{k}(n),t)\mathbf{Y}(\mathbf{k}(n),t)^{H}\right]$, where $\mathbf{Y}(\mathbf{k}(n),t)^{H}$ is the conjugate transpose of a matrix of received data for subchannels $\mathbf{k}(n)$.

11. The method of canceling noise interference according to claim 8 wherein $\mu(t)$ controls the adaptation according to normalized least mean squares and has a value determined according to an equation defined by: $\mu(t)=\dfrac{\alpha}{\beta+\mathbf{Y}(\mathbf{k}(n),t)^{H}\mathbf{Y}(\mathbf{k}(n),t)}$, where $\alpha\in(0,2)$, $0\leq\beta$, and $\mathbf{Y}(\mathbf{k}(n),t)$ is a matrix of received data for subchannels $\mathbf{k}(n)$.

12. The method of canceling noise interference according to claim 8 wherein $\mu(t)$ controls the adaptation according to power normalized least mean squares and has a value α determined according to an equation defined by: $\mu(t)=\dfrac{\alpha}{\sigma^{2}(t)}$, where $\sigma^{2}(t)=c\sigma^{2}(t-1)+|e(t)|^{2}$, $c\in(0,1)$, and $0<\alpha<\dfrac{2}{M}$.

13. A system for canceling communication system noise interference, the system comprising:

a multichannel frequency domain equalizer configured to receive T blocks of data, $\mathbf{Y}(:,t)$, $t=1,\ldots,T$, comprising T blocks of data, $\mathbf{X}(:,t)$, $t=1,\ldots,T$, transmitted over predetermined subchannels, wherein the multichannel frequency domain equalizer is operational to generate multichannel frequency domain equalization (FEQ) coefficients, $\mathbf{g}(n)$, associated with the n^{th} subchannel used to transmit the data, and to perform multichannel FEQ for the n^{th} subchannel using the generated multichannel FEQ coefficients, and further wherein the FEQ coefficients are associated with a set of subchannels, $\mathbf{k}(n)$, for the n^{th} subchannel used to transmit the T blocks of data.

14. The system according to claim 13 wherein the FEQ is operational to increase a subchannel signal-to-noise ratio beyond that achievable using a single channel FEQ.

15. The system according to claim 13 wherein the FEQ is operational to cancel correlated subchannel noise caused by deterministic noise spreading associated with a plurality of subchannels.

16. The system according to claim 13 wherein the FEQ is operational to increase achievable digital subscriber network data rate beyond that achievable using a single channel FEQ.